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The following communications were read :—

I. Some remarks on the Greenwich mural circles, by the Astronomer Royal.

The memoir lately published by Professor Airy, in which he notices some discordances in the zenith points of the Cambridge circle as determined by different stars observed directly and by reflection, induced Mr. Pond to examine whether one or both the mural circles of Greenwich exhibited the same defects. The observations of 1825 and 1826 being very numerous and carefully made, Mr. Pond has selected a series of differences of declinations between certain stars observed in those years. As the altitude of each star is obtained with each circle by direct and reflected vision, independently, (the stars being in fact observed as church steeples are with a theodolite,) it is evident that there are four combinations of differences between every pair of stars, wholly free from any hypothesis as to the absolute declinations, the agreement or disagreement of which will shew the accuracy or defects of the instruments. From the near coincidence of each result with the mean, Mr. Pond concludes that the circles were at that time in a satisfactory state.

II. Observations of the Solar Eclipse, July 16, 1833, at the Cambridge Observatory. By Professor Airy.

Professor Airy considers the beginning or end of a solar eclipse so unsatisfactory an observation compared with the mode adopted by him on the present occasion, that he did not think it worth while to note them at all. The instrument employed was a 5-feet equatorial by T. Jones, magnifying power 100, which has been noticed in the determination of the elongations of *Jupiter's* fourth satellite and of the parallax of *Mars*. The only sensible error in its adjustment was that in azimuth, which was unimportant in the present instance, as the middle of the eclipse was almost exactly at 6^h from the meridian. The observations were of differences of N.P.D. and differences of R.A. When differences of N.P.D., as of two cusps, were observed, the instrument was clamped in R.A., and one of the micrometer wires (this instrument has two), the position of which was previously read off, was brought upon the cusp by the tangent screw of the declination circle, as the cusp passed

the centre wire; and the time was noted. The second cusp was bisected by the second micrometer wire when it passed the centre wire, the time being also noted and the micrometer read off after the observation was made. The subjects registered in this observation are the clock times of the passages of the cusps, and the readings of the two micrometers when the wires were placed upon each. The differences of R.A. were obtained by observing the transits of each cusp over all five wires when the interval allowed, and in other cases over the three middle wires. These observations were carefully made on the same part of the wires, the declination circle being unclamped and moved by hand.

"By observing differences of either N.P.D. or R.A. of the cusps near the beginning and near the end of the eclipse, the effects of errors in R.A. and N.P.D. would have been obtained, largely multiplied, and combined in opposite ways; and by observing differences of N.P.D. of the cusps near the middle of the eclipse, the effects of errors of R.A. would have been obtained with large multipliers. The only defect in these determinations would be, that, as far as errors in the semidiameters of the sun and moon enter, they always enter with the same signs. There seems to be no good method of finding the effects of errors in the semidiameters combined with different signs, except by measuring the difference of declination of the N. or S. limbs when those of both bodies are visible. It would, perhaps, therefore, have been best to divide the duration of the eclipse into five nearly equal parts, and to observe difference of N.P.D. of cusps during the first, third, and fifth parts, and difference of N.P.D. of limbs during the second and fourth. I am here supposing the object to be (as mine was) to correct all the elements; if the object were only to ascertain differences of longitude (supposing the elements corrected), it would be best to observe differences of R.A. of the cusps during the second and fourth parts, as the whole of the measures thus obtained would vary rapidly with the time. Different considerations will be necessary in every different eclipse; and in none can measures be made to the utmost advantage without more of previous examination than I was able in the present instance to give."

The observations made are,

1. **Excess of N.P.D. of 1st cusp over that of 2d cusp. 6 observations.**
2. **Excess of N.P.D. of sun's lower limb over 1st cusp. 4 observations.**
3. **Excess of N.P.D. of sun's lower limb over moon's lower limb. 5 obs.**
4. **Excess of N.P.D. of 2d cusp over that of 1st cusp. 10 observations.**
5. **Excess of R.A. of 2d cusp over that of 1st cusp. 10 observations.**

After pointing out the mode in which the corrections for refraction, parallax, &c. are obtained, Professor Airy proceeds to calculate the small variations depending on the errors of the tables, and to obtain equations of condition involving the corrections of the R.A., N.P.D., and semidiameters of the sun and moon. The solution of these equations, on the supposition that the place of the sun in the *Berlin Ephemeris* is correct, shews that the true R.A. of the moon at the time of the eclipse is less than that of the *Berlin Ephemeris*

by 19″,30, and less than that of the *Nautical Almanac* by 18″,55, while the true north declination is less than that of the *Berlin Ephemeris* by 1″,26, and less than that of the *Nautical Almanac* by 1″,21. These are the corrections which ought to be applied to the tabular values of the moon's place in deducing longitudes, &c. from observations of this eclipse.

III. On the position of the ecliptic, as inferred from transit and circle observations, made at Cambridge Observatory, in the year 1833. By Professor Airy.

Those observations only were employed in which both limbs were observed; giving 140 transit, and 134 circle, observations, six microscopes being read for each limb in the latter. The clock errors were deduced from a catalogue differing from Pond's of 1112 stars by a mean excess of 0^s,11, and from Bessel's in the *Tab. Reg.* by a mean excess of 0^s,18.

In the circle observations, the first limb was observed by setting the instrument approximately, reading the microscopes, and measuring the distance of the limb from the fixed wire by a micrometer wire. The other limb was observed in the usual way. The refractions used were Bessel's, the parallaxes those of the *Berliner Jahrbuch*, both applied separately to each limb. The latitude of the place was derived from 917 observations, with six microscopes, of 10 circumpolar stars. See *Camb. Obs.* vol. vi. The method adopted, that of *Normal Places*, is thus described:

" In England, in deducing values of the obliquity, or places of the equinox, from a set of observations, the usual method has been to calculate from each observation by a trigonometrical operation the place of the equinox, &c., and to take the mean of all the places so found. The method of *Normal Places* consists in calculating trigonometrically no single observation whatever; but in comparing every observation with the place in the ephemeris, in taking the difference or apparent error of the ephemeris, in taking the mean of all those apparent errors over an extent of time in which we have *à priori* reason to think that they ought not to vary much, and then in considering that we have thus obtained, for the mean of all those times of observations, an error of the ephemeris which is very much more accurate than any one error. By applying this error with changed sign to a place in the ephemeris for a time near to the mean of the times of observation, we obtain a single corrected place, which possesses all the accuracy derived from the mean of numerous observations; and this is a Normal Place. The only requisites for the ephemeris to be used in these calculations are,—that it be consistently and accurately calculated on some elements, and that these elements be not extremely far from the truth (their being very near to it is of no importance whatever). We may now, if we please, use the Normal Places for trigonometrical calculation, or we may use the mean errors as the errors for the mean times, and make our whole calculation one of errors."

By grouping the observations for each month, in the manner